CLAIMS:

1. A method for bonding materials using localized microwave energy comprising the steps of:

applying a thin coating of a joining material to each surface of the base materials being joined,

disposing each said base material such that the surface of the base materials being joined are in contact with the desired alignment, and pressure necessary for maintaining the contact between the materials and creating the desired component assembly,

heating said joint area with a microwave beam applied to the surfaces of the base material being joined and focusing or diffusing said microwave beam to achieve localized heating of the joint area,

heating said joint area to an initial joining temperature, wherein said joining material softens and fills physical discontinuities between the surfaces of the base materials being joined,

rapidly heating said joint area to the reactive temperature of the joining material and the base materials,

maintaining said joint area at said reactive temperature to allow for the interdiffusion of the base and joining materials and formation of a homogenous joint region,

rapidly cooling said joint area to a recrystalization temperature and maintaining said joint area at the recystalization temperature for a predetermined period,

slowly cooling said joint area to room temperature.

2. The method of claim 1 wherein said joining material is a frit selected such that at a predetermined temperature the constituents of the frit material will chemically react and diffuse into the base material to form stable refractory compounds.

3. The method of claim 2 wherein said joining material is chemically reactive with the base material at a temperature below that of the thermal degradation threshold of the base material.

4. The method of claim 1 wherein said base materials are disposed and joined to create the desired assembly by employing low temperature fixtures to align said base materials and provide pressure to said joint area in the desired manner to produce the completed structure.

5. The method of claim 4 wherein said fixtures do not reach a temperature above 100 degrees Centigrade during the heating phases of the joining process.

6. The method of claim 1 wherein said initial joining temperature is approximately 800 to 1200 degrees Centigrade.

7. The method of claim 1 wherein said joint area is heated from the initial joining temperature to said reactive temperature at a rate of approximately 100 degrees Centigrade a minute.

8. The method of claim 1 wherein said reactive temperature is approximately 1500 to 1700 degrees Centigrade.

9. The method of claim 1 wherein said joint area is maintained at the reactive temperature for an interval of approximately 10 minutes.

10. The method of claim 1 wherein said recrystallization temperature is approximately 800 to 900 degrees Centigrade.

11. The method of claim 1 wherein said joint area is maintained at the recrystallization temperature for approximately 30 minutes, or until the joint area forms a stable physical and thermal structure.

12. The method of claim 1 wherein said base materials are high purity oxide materials.

13. The method of claim 1 wherein said fixtures do not reach temperatures above 100 degree Centigrade.

14. A multi component assembly formed by joining various base materials together having homogenous joints between said base materials formed by:

applying a thin coating of a joining material to each surface of the base materials being joined,

disposing each said base material such that the surface of the base materials being joined are in contact with the desired alignment, and pressure necessary for maintaining the contact and creating the desired component assembly,

heating said joint area with a microwave beam applied to the surfaces of the base material being joined and focusing or diffusing said microwave beam to achieve localized heating of the joint area,

heating said joint area to an initial joining temperature, wherein said joining material softens and fills physical discontinuities between the surfaces of the base materials being joined,

rapidly heating said joint area to the reactive temperature of the joining material and the base materials,

maintaining said joint area at said reactive temperature for a short interval to allow for the interdiffusion of the base and joining materials and formation of a homogenous joint region,

rapidly cooling said joint area to a recrystalization temperature and maintaining said joint area at the recystalization temperature for a predetermined period,

slowly cooling said joint area to room temperature,

wherein said joint region features similar physical, thermal and electrically characteristics as the base materials.

15. The device of claim 14 wherein said base materials are comprised of high temperature ceramics.

16. The device of claim 14 wherein the joining material used to coat the surfaces of the base materials being joined is largely eliminated from the joint regions by joint area heating.

17. The device of claim 15 wherein said base materials are comprised of high temperature ceramics having a purity of greater than 99%.

18. A method for bonding materials using localized microwave energy comprising the steps of:

applying a thin coating of a joining material, which is chemically reactive with the base material at a predetermined temperature, to each surface of the base materials being joined,

disposing each said base material such that the surface of the base materials being joined are in contact with the desired alignment, and pressure necessary for maintaining contact between the base materials and creating the desired component assembly,

heating said joint area with a microwave beam applied to the surfaces of the base material being joined and focusing or diffusing said microwave beam to achieve localized heating of the joint area,

heating said joint area to an initial joining temperature, wherein said joining material softens and fills physical discontinuities between the surfaces of the base materials being joined,

rapidly heating said joint area to the reactive temperature of the joining material and the base materials,

maintaining said joint area at said reactive temperature to allow for the interdiffusion of the base and joining materials such that the reactive material diffuses away into the bonded base material forming of a homogenous joint region,

rapidly cooling said joint area to a recrystalization temperature and maintaining said joint area at the recystalization temperature for a predetermined period,

cooling said joint area to room temperature.